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ABSTRACT

The objective of this study was to assess changes in verbalized cognitive inquiry behaviors of teachers and students who participated in the McREL Instruction Staff Development Program in Inquiry. Twenty-four participating secondary teachers were videotaped before and after instruction. Teacher and student verbalized inquiry behaviors were coded with the Revised Inquiry Analysis Instrument. Results indicated that "factual data" decreased from a mean of 61.7 percent to 32.0 percent while "data analysis and interpretation" increased from a mean of 14.1 percent to 39.4 percent. Other behaviors which increased included "affective behaviors", "sensory observations", "problem identification", and "assessment". Student Verbalization increased from 21.1 percent to 81.1 percent. (Author)

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AN ANALYSIS OF TEACHER AND STUDENT VERBALIZATION OF COGNITIVE INQUIRY BEHAVIORS BEFORE AND AFTER PARTICIPATION IN THE McREL ISD PROGRAM IN INQUIRY

by

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Introduction

The University of Nebraska Teachers College, Lincoln, in cooperation with the Mid-continent Regional Educational Laboratory (McREL), Kansas City, has conceptualized, developed and tested a staff development program designed for experienced teachers who are interested in improving inquiry learning in their classrooms.[1] The Instructional Staff Development (ISD) Program initially focuses on developing awareness of teaching behaviors and on self-analysis and self-assessment skills. Teachers then concentrate on behaviors and techniques for promoting inquiry learning behaviors on the part of students. The inquiry behaviors are identified as; (a) verbal influence behaviors,[2] (b) cognitive inquiry behaviors, and (c) affective inquiry behaviors.[3]

The purpose of this paper is to analyze and assess the effectiveness of the ISD program in developing cognitive inquiry behaviors. These behaviors include; identifying the problem, collecting data, analyzing and interpreting data, hypothesizing, identifying procedures, making sensory observations, and assessing the content, goal or process.

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[1]The paper, "Design for an Effective Staff Development Program," by Alan T. Seagren presented at the 1974 Annual Meeting of AERA provides an overview of the design and implementation of this program.

[2]The paper, "An Analysis of Teacher Verbal Inquiry Behavior Using the 'Inquiry Analysis System'" by Ronald Joekel presented at the 1974 Annual Meeting of AERA reports this aspect of the ISD program.

[3]The paper, "Developing/Identifying Student Affective Behaviors," by John E. Lux presented at the 1974 Annual Meeting of AERA reports this aspect of the ISD program.

Population and Procedures

The population of this study consisted of twenty experienced teachers from Lincoln and Omaha, Nebraska, area secondary schools who represented a variety of content areas. Participants had indicated interest in developing inquiry behaviors by enrolling in a two semester program for university credit.

The instructional treatment included six components or units of study conducted by four trainers who had participated in a workshop to prepare them to implement the ISD program. They each conducted approximately fifteen instructional sessions. Each participating teacher microtaught five times. Instructional topics included inquiry, verbal influence behaviors, behavioral objectives, cognitive inquiry behaviors and affective inquiry behaviors.

Each participating teacher was videotaped in one randomly selected class before participation in the ISD program and at the conclusion of instruction. Verbalized behaviors were coded from videotaped observations using the Revised Inquiry Analysis Instrument. Coders were consistent in the identification of categories of behavior at the 90 percent level.

Research Design

A quasi-experimental research design identified by Campbell and Stanley as the one-group Pretest-Posttest was:

$$O_1 \quad X \quad O_2$$

A correlated t-test was used to test the significance of change in observed behaviors.

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[1]Donald T. Campbell and Julian C. Stanley, Experimental and Quasi-Experimental Designs for Research, Chicago: Rand McNally and Co., 1966, p. 7.

Description of the Instrument

The Revised Inquiry Analysis System[1] is an observational instrument designed to simultaneously record three kinds of verbal behavior in three respective columns: (See Figure 1.)

(a) Column One: Categories one through ten identify the verbal influence behaviors as defined by the ten categories of Flanders Interaction Analysis.

(b) Column Two: Categories one through seven identify the verbal influence behaviors used by students and defined as being analogous to the seven categories of teacher behavior as defined by Flanders Interaction analysis.

(c) Column Three: Categories one through nine identify verbalized inquiry and noninquiry behaviors.

When this instrument was applied, a three-digit code was recorded every three seconds or with every behavior change, whichever occurred first. When the teacher was talking, the appropriate code was recorded in Column One, zero in Column Two (unless it was a decision), and the appropriate inquiry or noninquiry code in Column Three. For example, a teacher's factual question would be coded 401. If a student was speaking, an "8" or "9" was coded for Column One, the appropriate category was recorded for Columns Two and Three. For example, a student initiating a question about procedures would be recorded as 946. Silence or confusion was coded as 100.

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[1] This instrument was designed with input from the following: "The Inquiry Analysis System," Component III: Inquiry Behaviors, John E. Lux, et. al., July 1972, Copyright 1972 by Mid-continent Regional Educational Laboratory, Inc. pp. H308-1 to H308-4; "Cognitive Operations Monitored in the Classroom," Recording Teacher and Pupil Verbal Inquiry Behaviors in the Classroom, a technical manual for observers, John R. Anderson and Richard M. Bingman, October 1969, Copyright 1969 by McREL; and Inquiry Objectives in the Teaching of Biology, Richard M. Bingman, Editor, Copyright 1969 by McREL and the Biological Sciences Curriculum Study.

Figure 1

REVISED INQUIRY ANALYSIS SYSTEM INSTRUMENT

Column One (Interaction Analysis)	Column Two (Student Talk & Decisions)	Column Three (Inquiry Behaviors)
1 - Tchr. Accepts Feelings	1 - Student Accepts/States Feelings	1 - Factual Analysis
2 - Tchr. Reinforcement/Humor	2 - Student Reinforces/Humor	2 - Analysis, Interpretation, Identifying Relationships
3 - Tchr. Uses Student Ideas	3 - Student Uses Ideas of Others	3 - Hypotheses, Plans to Follow
4 - Tchr. Questions	4 - Student Questions	4 - Process (Inquiry into Inquiry)
5 - Tchr. Gives Information	5 - Student Gives Information	5 - Feelings, Attitudes, Values
6 - Tchr. Gives Directions	6 - Student Gives Directions	6 - Procedures
7 - Justification of Authority, Criticism by Tchr.	7 - Student Justifies Authority, Criticizes	7 - Sensory Observations
8 - Student Responses	8 - Decision based on Stated Alternatives	8 - Identification &/or Goal or Problem Formulation
9 - Student Initiated Talk		9 - Assessment of Content/Process
10 - Silence, Confusion	0 - Blank (Teacher Talk)	0 - Noninquiry

Hypotheses

It was hypothesized that:

1. After instruction in the ISD program, students would use a greater quantity of Column Two verbal influence behaviors.
2. After instruction in the ISD program, students would use a larger percentage of indirect than direct verbal influence behaviors.
3. After instruction in the ISD program, the mean percentage of time verbalizing decisions would increase.
4. After instruction in the ISD program, the total percentage of time that inquiry behaviors (excluding "factual data") are verbalized would be increased.

Results

Results in terms of the mean percentages of time spent in the behaviors identified in Columns One, Two and Three of the Revised Inquiry Analysis System are reported in this section.

Data on mean percentages of time spent in behaviors identified by Column One categories indicated that four of the seven "teacher-talk" categories decreased significantly. While "student response" also decreased significantly, "student initiated talk" increased at the .001 level of significance.[1]

Table I reports the mean percentages of time spent in behaviors identified by Column Two categories. Students did not accept feelings of other students, nor did they verbalize other students ideas. After

[1]A more detailed report on these behaviors can be found in the paper "An Analysis of Teacher Verbal Inquiry Behavior Using the Inquiry Analysis System" by Ronald Joekel presented at the 1974 Annual Meeting of AERA.

Table I

COMPARISON OF MEAN PERCENTAGES OF COLUMN TWO CATEGORIES, PRE AND POST OBSERVATIONS

	Category descriptions	PRE $\bar{X}$	PRE S.D.	POST $\bar{X}$	POST S.D.	t Value	Significance Level
1.	Student Accepts Feelings	0		0			N.S.
2.	Student Refinforces,Humor	.03	.13	9.81	16.70	-2.62	.01
3.	Student Uses Ideas of Others	.00	.00	.00	.00		N.S.
4.	Student Asks Questions	1.33	1.20	5.56	4.26	-4.47	.001
5.	Student Gives Information	16.67	8.04	54.83	15.51	-11.18	.001
6.	Student Gives Direction	.01	.03	1.15	1.52	-3.35	.01
7.	Student Criticizes or Justifies Authority	.01	.05	.38	.53	-3.05	.01
8.	Decisions	1.38	5.11	1.75	1.91	-.37	N.S.
9.	Student I/I + D	.09	.09	.24	.15	- 3.96	.01

instruction they significantly increased at the .01 level the use of "reinforcement", "direction-giving", and "criticism". Even more significantly, (at the .001 level), they increased their "questioning" and "information-giving" behaviors. While students increased the percentage of time they used indirect behaviors (from a mean of 1.36 percent to a mean of 15.39 percent), direct behaviors increased to an even greater proportion (from a mean of 16.69 percent to a mean of 56.36 percent).

Table II reports the mean percentages of time spent in behaviors identified by Column Three categories of cognitive inquiry behaviors. Total time using inquiry behaviors (excluding "factual data") increased from a mean of 18.21 percent to 54.26 percent. The verbalization of "factual data" decreased significantly at the .001 level from a mean of 59.73 percent to a mean of 32.08 percent. The greatest increase of verbalized behaviors was in the category of "data analysis, interpretation, and relationships" with an increase from a mean of 8.42 percent to a mean of 41.89 percent. This change was significant at the .001 level. "identifying goals/problems" increased at the .01 level of significance from a mean of .10 percent to a mean of .84 percent. Other verbalized inquiry behavior categories did not change significantly.

Conclusions

1. Hypothesis One was accepted with total student verbal influence behaviors increasing from a mean of 18.05 percent to a mean of 71.75 percent.

2. Hypothesis Two was rejected with the mean I/I+D ratio of student talk increased significantly from .01 to .24. While all changes in indirect behaviors were increased, the direct behavior of "information-giving" was the dominant behavior.

Table II

COMPARISON OF MEAN PERCENTAGES OF COLUMN THREE CATEGORIES, PRE AND POST OBSERVATIONS

	Category Descriptions	PRE $\bar{X}$	PRE S.D.	POST $\bar{X}$	POST S.D.	t Value	Significance Level
1.	Factual Data	59.73	23.56	32.08	19.78	4.10	.001
2.	Analysis, Interpretation Identifying Relationships	8.42	13.26	41.89	24.10	-5.29	.001
3.	Hypotheses, Plans	1.63	3.79	.08	.27	1.81	N.S.
4.	Process	.29	.89	.02	.05	1.40	N.S.
5.	Feelings/Attitudes/Values	.21	.63	1.21	3.25	-1.35	N.S.
6.	Procedures	6.04	3.93	7.67	7.45	-.82	N.S.
7.	Sensory Observations	.78	2.04	.45	1.45	.57	N.S.
8.	Identification of Goal/Problem	.10	.36	.84	1.11	-2.69	.01
9.	Assessment	.74	.34	2.10	2.23	-1.18	N.S.

3. Hypothesis Three was rejected. Even though the percentage of "decisions" was increased from a mean of 1.38 percent to a mean of 1.91 percent this change was not significant.

4. Hypothesis Four was accepted with the mean percentage of time verbalizing cognitive inquiry behaviors (excluding "factual data") increasing from 18.21 percent to 54.26 percent. The category , "Analysis, interpretation and relationships), increased from a mean of 8.42 percent to a mean of 41.89 percent. This was significant at the .001 level and was an important factor in this change.

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